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AUTHOR Danaher, Brian G.; Thoresen, Carl E.
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ABSTRACT

Three procedures for use in assessing imagery behavior were examined with the intent of finding a prognastic tool that would help the behavior therapist evaluate the applicability and/or the progress of an imagery intervention such as covert sensitization or implosion therapy. The authors attempted to replicate and extend portions of earlier perception studies which compared self-study include: (1) recall performance on a paired-associate learning task using imagery mediation; (2) self-reported and behavioral results from a Block Test of pattern recall; and (3) self-report data from an imagery questionnaire. The findings lead the authors to conclude that (1) the procedures examined require further evaluation before they can be used in diagnosis; and (2) the procedures should be expanded to include training in both somatic and visual sensory awareness and in techniques for assessing results. Directions for new research are noted. (Author/TL)

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IMAGERY ASSESSMENT BY MEANS OF SELF-REPORT AND BEHAVIORAL MEASURES

Brian G. Danaher and Carl E. Thoresen

School of Education
Stanford University
Stanford, California

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Introductory Statement

The Center is concerned with the shortcomings of teaching in American schools: the ineffectiveness of many American teachers in promoting achievement of higher cognitive objectives, in engaging their students in the tasks of school learning, and, especially, in serving the needs of students from low-income areas. Of equal concern is the inadequacy of American schools as environments fostering the teachers' own motivations, skills, and professionalism.

The Center employs the resources of the behavioral sciences--theoretical and methodological--in seeking and applying knowledge basic to the achievement of its objectives. Analysis of the Center's problem area has resulted in three programs: Teaching Effectiveness, Teaching Students from Low-Income Areas, and the Environment for Teaching. Drawing primarily upon psychology and sociology, and also upon economics, political science, and anthropology, the Center has formulated integrated programs of research, development, demonstration, and dissemination in these three areas. In the program on Teaching Effectiveness, the strategy is to develop a Model Teacher Training System integrating components that dependably enhance teaching skill. In the program on Teaching Students from Low-Income Areas, the strategy is to develop materials and procedures for engaging and motivating such students and their teachers. In the program on the Environment for Teaching, the strategy is to develop patterns of school organization and teacher evaluation that will help teachers function more professionally, at higher levels of morale and commitment.

The Personal Competencies component of the program on Teaching Effectiveness is concerned with developing methods to train persons such as teachers and students in behavioral skills. The present study reports on an exploratory examination of one type of behavior considered important for a personally competent individual: imagery. At present, methods of assessing the types and levels of imagery behavior are under study. Eventually, the assessment and training of imagery will comprise one facet of the Model Teacher Training System.

Abstract

Three possible procedures for use in assessing imagery behavior were examined with the intent of finding a prognostic tool that would help the behavior therapist evaluate the applicability and/or the progress of an imagery intervention. The measures included recall performance on a paired-associate learning (PAL) task using imagery mediation; self-reported and behavioral results from a Block Test of pattern recall; and self-report data from an imagery questionnaire (QMI). Correlations among the measures were computed, with attention given to the overlap of the behavioral and self-report measures. Behavioral measures of imagery behavior were found to have low correlations with each other even though they demonstrated considerable within-measure correspondence. By contrast, the imagery ratings of the several experimental tasks and the within-measure comparisons were found to have significant correlations. Self-report measures and behavioral measures were found to be significantly correlated only on the Block Test. It was concluded that the procedures examined require further evaluation for both convergent and discriminant validity before they can be used in diagnosis. In addition, it was concluded that the procedures should be expanded to include training in both somatic and visual sensory awareness and in techniques for assessing results. Directions for new research are noted.

IMAGERY ASSESSMENT BY MEANS OF SELF-REPORT AND BEHAVIORAL MEASURES

Brian G. Danaher and Carl E. Thoresen

Several recently devised therapy techniques require that the patient be able to imagine visual scenes vividly: for example, covert sensitization and covert reinforcement (Cautela, 1969, 1970, 1971), systematic desensitization (Wolpe, 1958, 1969), and implosion therapy (Stampfl & Levis, 1967). Since there are no physiological indicants that can reliably identify the presumed use or the quality of imagery behavior, the therapist who uses one of these techniques has generally had to rely on verbal self-reports as the primary index of how vividly a particular patient was able to experience in imagery. Because of the demonstrated effects of subtle situational variables on the content of verbal self-reports (see Rosenthal, 1966), a number of investigators have expressed the need for an empirical measure of imaging ability that is operationally independent of self-reporting (e.g., Davis, McLemore, & London, 1970; Rimm & Bottrell, 1969).

Our investigation attempted to replicate and extend portions of several recent perception studies comparing self-report and behavioral measures of imagery behavior (Sheehan, 1966; Rimm & Bottrell, 1969). It was hoped that the results might point the way toward more definitive research--which in turn might offer the behavior therapist an empirically based measure to complement self-reported internal experience when assessing the applicability and/or progress of an imagery intervention.

Method

Numerous researchers have shown that imagery significantly facilitates recall performance when used as a mediator in a paired-associate learning (PAL) paradigm (Bower, 1970, in press; Bugelski, 1970; Paivio, 1969; Paivio & Madigan, 1968; Reese, 1965; Rimm & Bottrell, 1969; Smith & Noble, 1965). Several of them have reported that imagery mediation is significantly more effective than rote repetition in PAL performance

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Brian G. Danaher was a research consultant for the Center and a research assistant in the Department of Psychology at Stanford University, 1970-71. He is now in the Department of Psychology, University of Oregon. Carl Thoresen is Associate Professor of Education at Stanford. The authors wish to thank M. J. Mahoney for his comments and suggestions.

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(Bower, in press; Mahoney, Thoresen, & Danaher, 1972; Paivio & Yuille, 1967, 1969).

In the first part of our investigation, subjects heard three lists of noun pairs under three different sets of instructions. Individual differences in recall performance under imagery instructions were felt to provide an observable criterion of imaging ability.

The subjects in the study (11 male, 11 female) were recruited from the undergraduate population at Stanford University and were paid $2.00 for their participation. The experiment was advertised as one involving "individual differences in memory and learning."

The subjects were seated at a table perpendicular to a one-way mirror in a small room. Procedural instructions were delivered via a tape recorder (Sony Model TC-18) which the experimenter operated from the adjoining room by remote control. The procedure followed that of a standard paired-associate learning task: pairs of nouns were presented, and later a recall test presented the first member of each pair, whereupon the subject was required to recall the associate of that member. The learning materials were three lists of fifteen relatively "concrete" noun pairs that had been used in the research of Bower (in press) and Mahoney et al. (1972). The lists were presented at a rate of 1:1 second with an interval of 9 seconds between pairs. When the three lists had been read, the recall test was administered. Each subject was randomly assigned to one of two sequences that systematically varied the associative method: either General-Imagery-Repetition or General-Repetition-Imagery. In order to allow for across-condition comparisons, each list was yoked to a particular associative strategy.

The second part of this study was concerned with the intercorrelations among the self-report, Block Test performance, and PAL measures. Rimm & Bottrell (1969) have reported a moderate but statistically significant correlation ($r = .31$, $p < .02$) between recall performance on a PAL task similar to the one already described and a picture memory test that required subjects to recall the spatial location of nine objects from a briefly exposed slide of an everyday scene. Sheehan (1966) has developed a sophisticated Block Test patterned on those commonly found in nonverbal intelligence tests. In addition, Sheehan renovated the Betts' Questionnaire Upon Mental Imagery (Betts, 1909), shortened it (1967), and performed a series of correlational analyses with it and various presentations of his Block Test. Briefly, Sheehan's research has illuminated the interaction between self-report and behavioral indices of imagery behavior--the "good imager" being operationally defined in terms of his performance on the Block Test.

In our study we attempted to (a) replicate that portion of Sheehan's (1966) findings dealing with the correlation between self-report and behavioral measures of imagery behavior, and (b) relate individual differences in performance on these two measures to that observed on the imagery list of the PAL recall test. Paivio (1969) has observed that

"successful prediction of the interactions involving the three classes of independent variables--stimulus attributes, experimentally manipulated mediators, and individual differences--would yield convergent evidence that their effects are mediated by common intervening processes (p. 259)." Generally, it was hoped that by integrating the research of Rimm and Bottrell with that of Sheehan, convergent evidence for a valid measure of imaging ability might be found.

Our procedure essentially followed Sheehan's (1966). The subject remained seated at the table on which were placed two boxes filled with a number of small blocks. On the subject's right there was a one-way mirror through which the proceedings were monitored and the slide images projected onto a reflective screen. The room was darkened except for a small portion of the tabletop, which was illuminated by a high-intensity study lamp. All instructions were delivered as before, via a tape recorder equipped with remote controls. The specific procedure was as follows:

> QMI: The subject was given Sheehan's shortened form of the Betts questionnaire (QMI). This form typically asks the respondent to rate his imagery of 50 imaginal scenes (e.g., "the whistle of a locomotive") on a scale of 1 to 7. A rating of 1 indicated "perfectly clear and as vivid as the actual experience"; a rating of 7 indicated "no image present at all, only knowing that you are thinking of the object."
>
> Perception: When the QMI was completed, the subject began the Block Test, in which he viewed and copied a slide-projected picture of a set of blocks arranged in a particular pattern. Three separate patterns were presented to each viewer: "Practice Pattern," "I," and "II," by Sheehan (1966). The blocks were 32 one-inch cubes divided into 4 sets of 8, each set having a different geometrical shape painted on the sides of the blocks in four different colors--one color per side.
>
> Kohs: A short attention control period was then allowed, during which the subject was engaged in a Kohs block procedure (Kohs, 1927) that required him to replicate an index-card design using a set of multicolored blocks.
>
> Recall and Rating: After 40 seconds had elapsed on the Kohs procedure, the subject was instructed to call to mind and retain an image of the picture he had seen on the screen one minute before. He was then instructed to rate his image, using the QMI scale, and to reproduce the design by placing his set of blocks in a particular pattern.

Each subject moved individually through the entire sequence three times, each time with a different stimulus pattern and Kohs' design. Except during the Kohs procedure, the subject was allowed to set his own pace.

Results

Self-Report of Vividness

All self-reported ratings of vividness were made using the QMI scale described earlier. The lower the assigned score, the higher the general quality of the imagery indicated. The mean QMI score was 86.27 (SD = 56.14). This overall value represented the sum of the scores on the seven Betts QMI scales that indicate the different modalities of imagery behavior. Each scale had five salient questions concerning the vividness of imaginal scenes. The overall or composite score indicating the highest possible quality of imagery was 35. In light of recent evidence (Hilgard, 1970) that the QMI visual modality alone adequately represented the QMI overall score, values from the QMI visual scale were individually correlated to the behavioral measures. The mean value for this visual scale was 10.64 (SD = 4.65).

The vividness of each Block Test pattern was indicated and the mean ratings were: 5.32 (SD = 1.13) for Block Test Practice Pattern (BT_p), 3.39 (SD = 1.55) for Block Test 1 (BT_1), and 3.38 (SD = 1.66) for Block Test 2 (BT_2). Thus, for other than BT_p, where subjects were uniformly unaware of the later pattern recall requirements of the procedure, self-reported vividness for the Block Test patterns clustered around the "moderately clear and vivid" and the "not clear or vivid but recognizable" categories on the QMI scale. The data suggest a trend toward increasingly vivid imagery as the experiment progressed.

Block Test Performance

Block Test performance scores for BT_p involved all 22 subjects, whereas the analyses for BT_1 and BT_2 were limited to data from 21 subjects owing to a tape recorder malfunction that prevented one subject from participating in the second and third pattern procedures. After each subject completed the pattern recall, his performance received a score indicating the number of blocks misplaced. The maximum possible number of errors were 9, 9, and 12 for BT_p, BT_1, and BT_2, respectively. The mean errors of location were 6.18 (SD = 2.04) for BT_p, 4.24 (SD = 3.22) for BT_1, and 4.86 (SD = 3.76) for BT_2. A moderate correlation was found between BT_2 performance scores and scores from both BT_1 and BT_p.

Paired-Associate Learning Performance

Within the paired-associate learning paradigm the three conditions were designated PAL(I) for imagery instructions, PAL(G) for no instructions, and PAL(R) for repetition instructions. For each of the three noun lists a correct response was scored as +1; the maximum possible score for each list was +15. The mean performance scores were: 11.45 (SD = 2.84) for PAL(I), 4.41 (SD = 2.75) for PAL(R), and 10.14 (SD = 3.54) for PAL(G). A t-test performed on the difference of the means of PAL(I)

and PAL(R) revealed a significant difference, $t(22) = 8.43$, $p < .002$. The difference between the means of PAL(I) and PAL(G) was not significant.

An analysis of the change in recall performance from PAL(R) to PAL(I) revealed that 63 percent more words were correctly recalled when imagery was used as the associative method. This finding was taken as further support for the literature (e.g., Bower, in press) indicating that mediation by an imagery strategy is significantly more effective than rote repetition in the PAL paradigm.

Intercorrelations Among Measures

Pearson product moment correlations (two-tailed) among the aforementioned measures are presented in Tables 1 and 2. Only the cells bearing directly on the issues of the present discussion were computed. The data from Table 1 indicate little correlation between the two behavioral measures of imagery behavior (Block Test and PAL). Although PAL measures were highly related to one another, they failed to reach a significant level on between-measure analyses with Block Test performance--with the curious exception of PAL(R). In an effort to clarify this interaction, a chi-square with Yates' correction for continuity was performed on Block Test and PAL(R) comparisons. The result was not significant for BT_1 ($X^2 = .71$); BT_2 errors of location

TABLE 1

Product Moment Correlations Between
Behavioral Measures (PAL & Block Test)

	Performance Measures				
	BT_1 errors	BT_2 errors	PAL(G)	PAL(I)	PAL(R)
BT_p errors	+.16	+.48*	-.06	-.13	-.24
BT_1 errors		+.45*	-.34	-.28	-.45*
BT_2 errors			-.44	-.26	-.45*
PAL(G)				+.74†	+.65†
PAL(I)					+.65†

*$p < .05$
†$p < .002$

and PAL(R) were significantly associated ($X^2 = 5.86$, $p < .025$). An interpretation of this finding is explored below.

Although the correlations between PAL(I) and Block Test measures were not found to be significant, they were numerically comparable to those reported by Rimm & Bottrell (1969). However, when partial correlations analogous to those of Rimm & Bottrell were computed with our data, the resulting values clustered around 0.

Table 2 presents correlations among the various self-report and behavioral measures. Although Sheehan's (1966) findings were replicated to the extent that a significant correspondence was established between Block Test performance and Block Test self-reported vividness, there was no such correspondence between either Block Test performance and self-report measures from other tasks or Block Test self-reported vividness

TABLE 2

Product Moment Correlations Among Self-Report and Behavioral Measures

	Self-Report				
Behavioral measures	QMI Visual	QMI Overall	BT_p Vividness	BT_1 Vividness	BT_2 Vividness
BT_p errors	+.35	+.16	+.75†		
BT_1 errors	+.11	0.00		+.62***	
BT_2 errors	+.25	+.03			+.52**
PAL(I)	+.30	+.36	-.56***	-.11	+.03
QMI visual rating		+.43*	+.38	+.45*	+.57***

*p < .05
**p < .02
***p < .01
†p < .002

and the PAL behavioral measures. However, Block Test self-report measures were found to significantly correlate with both QMI overall and QMI visual self-report data.

In summary, then, the data revealed considerable specificity in the performance scores, in contrast to the marked generality of the self-report ratings of vividness derived from the various tasks. Self-report and behavioral scores were found to correlate significantly only when both were obtained from one task--the Block Test.

Discussion

The results of our investigation suggest that a reliable and valid behavioral measure of individual differences in imaging ability requires additional empirical attention before any assessment procedure can be suggested for general clinical application.

The strong relationship between behavioral performance and self-reported vividness ratings for each of the Block Tests would seem to confirm the utility of self-report data. This confidence must be tempered, however, for three reasons. First, the lack of any significant correspondence between the behavioral measures of imagery behavior (PAL and Block Test) throws into question the convergent evidence that imagery behavior was in fact being assessed. Second, the fact that self-reported vividness on each Block Test often occurred after the blocks had been arranged under pattern recall instructions may have made it impossible to tell whether the ratings reflected the quality of the image or simply the success with which a credible and complete replica of the pattern had been constructed. If the latter case were true, then the strong relationship between behavioral and self-report data would have to be explained more cautiously as simply two congruent descriptions of a performance. Finally, the use of exactly the same 7-point QMI rating scale to assess self-reports on both the Block Test and all QMI measures may have artificially promoted a sense of correspondence, i.e., through the confounding of response sets or other systematic biases. Future investigations should attempt to control for these alternate explanations.

A careful examination of Table 1 reveals paradoxical data indicating that PAL(R) predicted Block Test performance at a higher level than did PAL(I). The paradox arises from the fact that PAL(R) instructions specified rote repetition as the associative strategy rather than imagery mediation. Present anecdotal evidence corroborates the conclusions of Paivio & Yuille (1967, 1969), Bower (in press), and Mahoney et al. (1972), who found that when given PAL(R) instructions individuals generally reverted to the associative habits aroused by the semantic characteristics of the words to be learned. In such instances "concrete" nouns tended to arouse imagery mediation. Paivio (1969) labeled this phenomenon the "two-process theory of associative meaning and mediation." It remains for future research to ascertain whether the frequency of such inferred spontaneous imagery mediation in PAL(R) might have facilitated recall performance and thus might, in turn, provide an index of individual differences in imaging ability. An alternate explanation for the same data might assert that general intelligence was measured rather than imaging ability specifically.

The clinical implications of these findings suggest that one or more of the procedures examined might tentatively be incorporated into an exploratory assessment program. Strict reliance on the visual modality, however, may not reflect the imagery characteristic of a particular intervention: for example, implosion might require the patient to imaginally experience the tactile sensations of intimate interaction with a phobic object; covert sensitization might require the evocation of gustatory and olfactory as well as visual stimuli in the imaginal experience of nausea. Visual assessment procedures of the type presented here would not appear to represent the requisite imagery of these interventions adequately.

Simply visualizing an imaginal scene is not sufficient in most therapeutic regimens; rather, actual involvement in the scene itself, with the patient as actor, is more often required. Indeed, in describing several novel methods of training imaginal responses, Phillips (1971) has asserted that this capacity both to visualize images and to "be in them" concurrently reflects the equal importance of visual and somatic sensory awareness in imagery intervention. The development of a procedure embodying both the assessment of visual imaging ability and training in sensory awareness awaits investigation.

In conclusion, the validity of any imagery assessment procedure must remain in doubt until convergent evidence from behavioral measures can be obtained. Furthermore, the influence of the subject's general intelligence on imagery behavior must be evaluated in order to establish the discriminant validity of the procedure(s) involved (see Campbell & Fiske, 1959). Future investigations should be directed toward expanding the procedures we tested to include the assessment of a person's imagery behavior and also the training of somatic and sensory awareness if a deficit is found. Finally, research into the outcomes of therapy, along the lines suggested by Davis et al. (1970), must be explored in order to ascertain what clinical usefulness a particular procedure might have.

References

Betts, G. H. The distributions and functions of mental imagery. New York: Columbia University Teacher's College, 1909. Contributions to Education, No. 26.

Bower, G. H. Analysis of a mnemonic device. American Scientist, 1970, 58, 496-510.

Bower, G. H. Mental imagery and associate learning. In L. Gregg (Ed.), Cognition and learning in memory. New York: Wiley, in press.

Bugelski, B. R. Words and things and images. American Psychologist, 1970, 25, 1002-12.

Campbell, D. T., & Fiske, D. W. Convergent and discriminant validation by the multitrait-multimethod matrix. Psychological Bulletin, 1959, 56, 81-105.

Cautela, J. R. The use of imagery in behavior modification. Paper presented at the Annual Meeting of the Association for the Advancement of Behavior Therapy, Washington, D. C., 1969.

Cautela, J. R. Covert reinforcement. Behavior Therapy, 1970, 1, 35-50.

Cautela, J. R. Covert Conditioning. In A. Jacobs & L. B. Sachs (Eds.), The psychology of private events. New York: Academic Press, 1971. Pp. 112-30.

Davis, D., McLemore, C. W., & London, P. The role of visual imagery in desensitization. Behavior Research and Therapy, 1970, 8, 11-13.

Hilgard, J. R. Personality and hypnosis. Chicago: The University of Chicago Press, 1970.

Kohs, S. C. Intelligence measurement. New York: Macmillan, 1927.

Mahoney, M. J., Thoresen, C. E., & Danaher, B. G. Covert behavior modification: An experimental analogue. Technical Report No. 24 Stanford, Calif.: Stanford Center for Research and Development in Teaching, 1972.

Paivio, A. Mental imagery in associative learning and memory. Psychological Review, 1969, 76, 241-63.

Paivio, A., & Madigan, S. Imagery and association value in paired-associate learning. Journal of Experimental Psychology, 1968, 76, 35-39.

Paivio, A., & Yuille, J. C. Mediation instructions and word attributes in paired-associate learning. Psychonomic Science, 1967, 8, 65-66.

Paivio, A., & Yuille, J. C. Changes in associative strategies and paired-associate learning over trials as a function of word imagery and type of learning set. Journal of Experimental Psychology, 1969, 79, 458-63.

Phillips, L. W. Training of sensory and imaginal responses in behavior therapy. In R. D. Rubin, H. Fensterheim, A. A. Lazarus, & C. M. Franks (Eds.), Advances in behavior therapy. New York: Academic Press, 1971. Pp. 111-22.

Reese, H. W. Imagery in paired-associate learning in children. Journal of Experimental Child Psychology, 1965, 2, 290-96.

Rimm, D. C., & Bottrell, J. Four measures of visual imagination. Behavior Research and Therapy, 1969, 7, 63-69.

Rosenthal, R. Experimenter effects in behavioral research. New York: Appleton-Century-Crofts, 1966.

Sheehan, P. W. Functional similarity of imaging to perceiving: Individual differences in vividness of imagery. Perceptual and Motor Skills, 1966, 23 (Monogr. Suppl. 6), pp. 1011-33.

Sheehan, P. W. A shortened form of Betts' Questionnaire Upon Mental Imagery. Journal of Clinical Psychology, 1967, 23, 386-89.

Smith, R. K., & Noble, C. E. Effects of a mnemonic technique applied to verbal learning and memory. Perceptual and Motor Skills, 1965, 21, 123-34.

Stampfl, T. G., & Levis, D. J. Essentials of implosion therapy: A learning-theory-based psychodynamic behavioral therapy. Journal of Abnormal Psychology, 1967, 72, 496-503.

Wolpe, J. Psychotherapy by reciprocal inhibition. Stanford, Calif.: Stanford University Press, 1958.

Wolpe, J. The practice of behavior therapy. New York: Pergamon Press, 1969.

Appendix A

PAL Instructions

We are interested in learning how people associate words. Previous research has indicated that the manner in which words are associated depends greatly on the particular individual and the words to be associated. We will therefore be asking you to associate noun pairs using specific associative methods.

A later test, during which you will be given the first member of a pair and asked to recall the second, will tell us how well you do. The pairs will be given fairly rapidly so you can't spend too much time associating them. Be sure to use only the associative method described in the instructions.

You will be given a total of three lists, each containing 15 pairs. After the end of all three lists, a recall test will be given. It will be announced by the words "recall test." You should then use one of the sheets marked "recall test" and try to remember the second word of each pair as the first word is called out. Write down your answer on the appropriate line of the recall test. If you can't remember an answer, leave that space blank. At the end of the test, the word "stop" will signal that you should turn your answer sheet over and put it face down on the desk.

GENERAL We are now ready for list one. In this list you are to use any associative method you wish. We are interested in how you normally approach this kind of test, so use your normal associative method or methods) on this list.

List 1:

icebox.....caravan
acrobat.....bolt
mule.....library
factory.....hairpin
grass.....harp
grandmother..college
corn.....board
accordian....arrow
exhaust.....macaroni
frog.....cabin
cigar.....glacier
city.....judge
chief.....boulder
bouquet.....brain
gold.....candy

IMAGERY In list (2 or 3) you are to associate the noun pairs by using an imagery technique. For example, you might be asked to associate the noun pair "dog : bicycle." Using the imagery technique, you would produce some image or picture of a dog and bicycle together--for example, a dog chasing a bicycle. Be sure to use only the imagery technique to associate the following pairs.

List 2 or 3:

elbow.....fire
hurricane....skull
doll.....blacksmith
avenue.....coffee
beaver.....goblet
fox.....magazine
cradle.....bacteria
door.....square

ink.....cane
beggar.....cowhide
cat.....lake
dress.....ghost
horse.....admiral
circle.....beast
chin.....blood

REPETITION In list (3 or 2) you are to associate the noun pairs by using a repetition technique. For example, you might be asked to associate the noun pair "dog : bicycle." Using the repetition technique, you would repeat the pairing over and over again to yourself: dog : bicycle; dog : bicycle; dog : bicycle. Be sure to use only the repetition technique to associate the following pairs.

List 3 or 2:

cattle.....daffodil
church.....microscope
blossom.....butcher
lemonade.....newspaper
hammer.....arm
artist.....thorn
engine.....bay
cobblestone..python

policeman...galaxy
ankle.....cellar
hillside....corpse
caterpillar.forest
suds.....revolver
child.....pudding
alligator...fisherman

STOP. That completes all the lists. Turn over the recall test answer sheets located on your right and prepare for the recall test.

RECALL TEST

Appendix B

Shortened Form of the Questionnaire Upon
Mental Imagery (Betts, 1909)

Directions: The seven grades or degrees of clearness and vividness printed in the KEY below will give you a standard by which to determine your answers to the questions on the tests. Read and reread it until you fully understand what each grade or degree means. Keep the KEY before you as you answer the questions, and refer to it constantly in deciding what your answers shall be. Please answer all the questions. Simply write the number (3, 5, 2, etc.) that corresponds to the degree of clearness and vividness on which you decide for your image. Do not hurry in answering the questions, and answer each strictly on its own merits, that is, regardless of how you have answered any other one.

KEY for answering questions

With respect to the mental picture suggested in each of the questions of the test, is the image that comes before your mind:

1. Perfectly clear and as vivid as the actual experience. Or
2. Very clear and comparable in vividness to the actual experience. Or
3. Moderately clear and vivid. Or
4. Not clear or vivid but recognizable. Or
5. Vague and dim. Or
6. So vague and dim as to be hardly discernible. Or
7. No image present at all, only knowing that you are thinking of the object.

Think of some relative or friend whom you frequently see, considering carefully the picture that rises before your mind's eye, and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified in the KEY:

[ ] 1. The exact contour of face, head, shoulders, and body.
[ ] 2. Characteristic poses of the head, attitudes of the body, etc.
[ ] 3. The precise carriage, length of step, etc., in walking.
[ ] 4. The different colors worn in some familiar costume.

NOTE: Dashed lines mark separate pages in the questionnaire booklet.

Think of seeing the following, considering carefully the picture that comes to your mind's eye; classify the images suggested by the following questions, as indicated by the degrees of clearness and vividness specified in the KEY:

[ ] 5. The sun as it is sinking below the horizon.

Recall some perfectly familiar tune, considering carefully the image of the sound that comes to your mind's ear, and classify the images suggested by each of the following questions according to the degrees of clearness and vividness specified in the KEY:

[ ] 6. The whistle of a locomotive.
[ ] 7. The honk of an automobile.
[ ] 8. The newing of a cat.
[ ] 9. The sound of escaping steam.
[ ] 10. The clapping of hands in applause.

Think of "feeling" or touching each of the following, considering carefully the image that comes to your mind's touch, and classify the images suggested by each of the following questions according to the degrees of clearness and vividness specified in the KEY:

[ ] 11. Sand.
[ ] 12. Linen.
[ ] 13. A fur muff.
[ ] 14. The prick of a pin.
[ ] 15. The warmth of a tepid bath.

Think of performing each of the following acts, considering carefully the image (do not confound this with incipient movement of the muscles concerned) that comes to your mind's arms, legs, lips, etc., and classify the images suggested according to the degrees of clearness and vividness specified in the KEY:

[ ] 16. Running upstairs.
[ ] 17. Springing across a gutter.
[ ] 18. Drawing a circle on paper.
[ ] 19. Reaching up at a high shelf.
[ ] 20. Kicking something out of the way.

Think of tasting each of the following, considering carefully the image that comes to your mind's mouth, and classify the images suggested by each of the following questions according to the degrees of clearness and vividness specified in the KEY:

[ ] 21. Salt.
[ ] 22. Granulated (white) sugar.
[ ] 23. Oranges.
[ ] 24. Jelly.
[ ] 25. Your favorite soup.

Think of smelling each of the following, considering carefully the image that comes to your mind's nose and classify the images suggested by each of the following questions according to degrees of clearness and vividness specified in the KEY:

[ ] 26. An ill-ventilated room.
[ ] 27. Cooking cabbage.
[ ] 28. Roast beef.
[ ] 29. Fresh paint.
[ ] 30. New leather.

Think of each of the following sensations, considering carefully the image that comes before your mind, and classify the images suggested according to degrees of clearness and vividness specified in the KEY:

[ ] 31. Fatigue.
[ ] 32. Hunger.
[ ] 33. A sore throat.
[ ] 34. Drowsiness.
[ ] 35. Repletion (as from a very full meal).